

We claim:

SUB A1

1. In a video coder for coding video images in a block format, a method for improving compression of the video images comprising:

5 predicting x and y motion vector components for a current block of pixels based on a motion vector of at least one neighboring block of pixels to compute x and y components of a predictor motion vector;

computing differential x and y components from the x and y components of the predictor and x and y components of a motion vector for the current block; and

10 assigning a single variable length code to joint x and y differential motion vector components, such that shorter variable length codes are assigned to joint differential motion vector components that have a higher probability of occurrence in the video images, and longer variable length codes are assigned to joint differential motion vector components that have a lower probability of occurrence.

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2. The method of claim 1 wherein the variable length codes are assigned from a variable length code table comprising a list of pairs of joint differential motion vector components and a corresponding variable length code for each pair of joint differential motion vector components.

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SUB A2

3. The method of claim 2 wherein the assigning step includes:

looking up the joint differential motion vector components in the table;

when no match is found in the table, coding an escape code along with a fixed

length code for each differential motion vector component.

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4. The method of claim 1 wherein the block of pixels corresponds to a macroblock in a video frame divided into fixed-sized, rectangular macroblocks, and the predicting computing, and assigning steps are repeated for the macroblocks in the video frame.

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5. The method of claim 1 wherein the block of pixels corresponds to a macroblock of a video object plane in video frame having two more video object planes, and the video object planes are each divided into fixed-sized, rectangular macroblocks; and

5 the predicting, computing and assigning steps are repeated for the macroblocks in the video object planes.

6. A computer readable medium having instructions for performing the steps of claim 1.

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7. In a video decoder, a method for decoding macroblocks of a predicted video frame comprising:

receiving a single variable length code representing joint x and y components of a motion vector for each of the macroblocks;

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for each of the macroblocks, searching for a single entry in an entropy codebook corresponding to the variable length code and including the x and y components of the motion vector; and

using the x and y components of the motion vector from the codebook to define motion of pixels in a corresponding macroblock.

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8. The method of claim 6 wherein the x and y components of the motion vector in the codebook comprise x and y differential motion vector components, and the method comprises:

reconstructing the motion vector from the differential motion vector components and x and y components of a predictor motion vector.

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9. The method of claim 6 wherein the codebook is a Huffman table trained for a target bit rate and content type from a statistical analysis of example video sequences having the content type.

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~~SUB A3~~ 10. A computer readable medium having instructions for performing the steps of claim 7.

11. A motion vector encoder comprising:

5 a motion vector predictor for computing a motion vector predictor for a motion vector of a block of pixels from at least one motion vector for a neighboring block of pixels;

a subtractor for computing differential motion vector components from motion vector components of the predictor and the motion vector of the block of pixels; and

10 a joint entropy coder for jointly coding the differential motion vector components with a single variable length code.

~~11~~ 12. The encoder of claim ~~11~~ ¹⁰ wherein the joint entropy coder computes the single variable length code by searching for the code in a Huffman coding table
15 comprising a list of joint differential motion vectors and a corresponding variable length code for each of the joint differential motion vectors.

~~SUB A4~~

13. A motion vector decoder comprising:

20 a motion vector predictor for computing a motion vector predictor for a motion vector of a block of pixels from at least one motion vector for a neighboring block of pixels;

a joint entropy decoder for decoding a single variable length code into joint differential motion vector components; and

25 an adder for reconstructing X and Y motion vector components from the joint differential motion vector components and X and Y components of the motion vector predictor.

14. The decoder of claim 13 wherein the joint entropy decoder decodes the single variable length code by searching for the code in a Huffman coding table

~~comprising a list of variable length codes and corresponding joint differential motion vector components for each the variable length codes.~~

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~~15.~~ The decoder of claim ~~13~~¹² wherein the joint entropy decoder is operable to
- 5 detect an escape code indicating that two fixed length codes representing X and Y differential motion vector components follow the escape code.

- SUB A5** ~~16.~~ In a video coder for coding video images in a block format, a method for improving compression of the video images comprising:
- 10 computing x and y motion vector components for a block;
forming the x and y motion vector components into a joint parameter representing joint x and y motion vector components; and
assigning a single variable length code to the joint x and y motion vector components, such that shorter variable length codes are assigned to joint motion vector
- 15 components that have a higher probability of occurrence in the video images, and longer variable length codes are assigned to joint differential motion vector components that have a lower probability of occurrence.

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~~17.~~ The method of claim ~~16~~¹⁴ further including spatially predicting the x and y
- 20 motion vector components from a neighboring block of the block; and using spatially predicted components as the joint x and y motion vector components.

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~~18.~~ The method of claim ~~17~~¹⁵ wherein the spatially predicted components are differential motion vector components computed as a difference between x and y
- 25 components of the motion vector for the block and x and y components of a predictor motion vector.

- SUB A6** ~~19.~~ In a video decoder, a method for decoding macroblocks of a predicted video frame comprising:

